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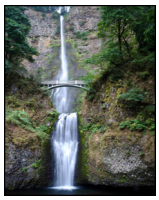

Leveraging cognitive consistency to nudge conservative climate change beliefs

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ABSTRACT

People feel motivated to maintain consistency across many domains in life. When it comes to climate change, many find themselves motivated to maintain consistency with others, e.g., by doubting climate change to cohere with friends' and neighbors' beliefs. The resulting climate skepticism has derailed discussions to address the issue collectively in the United States. To counteract these social consistency pressures, we developed a cognitive consistency intervention for climate skeptics. We first demonstrated that most people share substantial faith in a variety of scientific findings, across disciplines ranging from medicine to astronomy. Next, we showed that conservative participants who first acknowledged several general contributions of science subsequently reported significantly stronger beliefs in climate science (as compared to conservatives who were asked only about their climate science beliefs). These findings provide an encouraging proof-of-concept for how an inclusive climate conversation might be initiated across the political divide.

1. Introduction

We like to think that we think for ourselves. Yet, others influence our attitudes, behaviors, and beliefs in ways we may be unaware of. When our beliefs diverge from others in our social network, we often become motivated to address that inconsistency.

This motivation for social consistency has been particularly problematic for addressing climate change. Despite 97% of climate scientists agreeing that climate change is real, urgent, and human-caused, 28% of Americans think global warming results from natural temperature fluctuations (Leiserowitz et al., 2018). Such beliefs may persist because believing in climate change might strain social relationships when friends and neighbors believe otherwise (Kahan, 2015). The pervasiveness of climate skepticism has resulted in a dearth of collective conversations to address global warming in the United States.

However, social consistency is not the only influence on our attitudes—incompatible cognitions often motivate people to restore mental equilibrium (e.g., Festinger, 1962). In this pre-registered replication experiment, we embrace a broad theoretical conceptualization of people's motivation to maintain social and cognitive consistency. Focusing on climate change skeptics, we test a cognitive consistency intervention designed to promote greater belief in climate change. As a theoretically-grounded proof-of-concept, this intervention illustrates how cognitive consistency motives might counteract extant consistency pressures from society.

1.1. The problem of social consistency and climate skepticism

The motivation to maintain social consistency can take many forms, including similarity, social norms, and social proof. For example, to gain acceptance among a group of climate skeptics some might feel pressure to conform by adopting similar views (see Montoya, Horton, & Kirchner, 2008 for more on similarity). Others, who are uncertain about climate science, might look to respected authorities in their social sphere to adopt socially-appropriate opinions (see Cialdini, 2009 for more on social norms and social proof). Because of the many pathways to maintaining social consistency, we focus our theoretical understanding of climate skepticism at the broad level of social consistency rather than specifying a particular psychological mechanism (e.g., similarity or social proof).

However, in targeting interventions for specific populations in particular contexts, researchers need more precision to understand who likely climate skeptics are. Some research suggests that social consistency pressures to disbelieve climate change stem from the political right (Leiserowitz et al., 2018; Oreskes & Conway, 2010). Other research proposes that people's worldview better explains which social groups will engage in “motivated reasoning” around climate change. Specifically, Kahan et al. (2012) show that those with more egalitarian/

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communitarian worldviews believe in climate change more than their hierarchical/individualistic counterparts. To accurately target interventions regarding people's climate attitudes, researchers need to accurately identify climate skeptics.

1.2. The promise of cognitive consistency

Complementing people's powerful motivations to maintain social consistency, several lines of research show potent effects of cognitive consistency interventions. Like social consistency motivations, cognitive consistency might manifest through different specific psychological mechanisms such as cognitive dissonance (Aronson, 1992; Festinger, 1962) or foot-in-the-door effects (e.g., Cialdini, 2009). Even Piaget's (1977) learning theory can be viewed as relying on cognitive consistency motivations—learners are motivated to change their understanding of the world only when their current schemas appear inconsistent with their observations and thus need to be replaced by new schemas to restore cognitive equilibrium.

In sum, we theorize that climate change skeptics and believers are both motivated to hold attitudes that cohere with the social groups to which they belong (e.g., their political party or those who share their worldview). Creating cognitive inconsistencies for climate skeptics could counteract the social consistency pressures they face in their communities, potentially shifting their beliefs.

1.3. Intervention and hypotheses

To generate cognitive inconsistency among climate skeptics, we drew from recent work showing how surveys can be used as interventions (Gehlbach, Robinson, Finefter-Rosenbluh, Benshoof, & Schneider, 2018). Despite recent evidence that conservative's confidence in science has eroded in recent decades (Gauchat, 2012), we expected that most people find some branches of science credible, even if they doubt others. Combining these two ideas, we leveraged the motivation for cognitive consistency to try to shift the views of climate science skeptics by asking first about their beliefs in science before asking them about climate science.

Based on the potential political and worldview differences in climate beliefs (Kahan et al., 2012; McCright, Dunlap, & Xiao, 2013) and a preliminary exploratory study, we pre-registered the following hypotheses in line with recommended practices (Gehlbach & Robinson, 2018):

1) Conservative participants experiencing the consistency intervention would report greater belief in climate science than their control counterparts.
2) Across the full sample, the treatment would disproportionately increase beliefs in climate science for participants with less egalitarian perspectives.

2. Methods

A preliminary exploratory study tested whether our cognitive consistency intervention could counteract the social pressure many Americans feel to disbelieve climate change. We found that our approach effectively shifted the attitudes of politically conservative participants. This study also indicated that participants' egalitarian beliefs (though not their communitarian beliefs) might be a more powerful moderator than political orientation (Kahan et al., 2012). Thus, we included egalitarianism but omitted communitarianism as measures in our pre-registered study. Appendix A of the supplementary online materials details this exploratory study.

2.1. Participants

To have sufficient numbers of conservative participants, we sought 750 U.S. participants from Amazon's Mechanical Turk. From the 906 participants who entered the survey, we obtained a final analytic sample of 699. We present full details of how attrition and exclusions occurred at the end of Appendix B.

The sample was 57% female (M_{age} = 38.2 years, SD = 10.9), and the median participant held a four-year college degree. Participants identified as White (79%), Black/African American (10%), Asian/Pacific Islander (5%), and Latinx/Hispanic American (4%). Politically, 27.5% of the participants categorized themselves as conservative, 22.6% as moderate, and 49.9% as liberal.

2.2. Measures

Three survey scales comprised the central measures. Our *belief in science,* scale asked items such as, “How credible is the medical data that germs are a primary cause of disease?” and “How certain are you that physicists' theory of gravity accurately explains why objects fall when dropped?” The seven-item scale yielded reasonable internal consistency (α = 0.82). See Supplementary Materials for details on all scales.

Our seven-item *belief in climate science* scale (α = 0.97) paralleled the *belief in science* scale in form and tone. Through this scale, we assessed respondents' faith in a set of *climate* science findings. For instance, we asked, “How credible is the climate science data that ocean temperatures are rising?” and “How certain are you that global warming explains many of the new weather patterns we are seeing today?”

We adapted our *egalitarianism* scale from Kahan, Jekins-Smith, and Braman (2011). Our four-item scale (α = 0.87) assessed the degree to which participants valued greater societal equality and worried about inequality through items like, “How serious a problem is discrimination in the United States today?” Finally, participants indicated their political orientation by selecting one of 7 response options, extending from “very/somewhat/slightly liberal” to a midpoint of “moderate” to “slightly/somewhat/very conservative.”

Across all scales—original and adapted—we employed current best practices in item wording and designing survey scales (Dillman, Smyth, & Christian, 2014; Gehlbach, 2015; Gehlbach & Artino, 2018). The main measures are listed in Appendix B.

2.3. Procedures

In early December 2017, we recruited Mechanical Turk “experts” and randomly assigned these participants to treatment or control. Treatment participants first completed the *belief in science* questions. Next, both conditions answered the *belief in climate science* items. In other words, the first survey scale served as an intervention to shift treatment respondents' beliefs on the second scale. From that point onward, all participants responded to all survey items in the same order. We paid respondents $2.00 upon completion of the survey. The full list of variables collected can be found in our pre-registered *Statement of Transparency* (https://osf.io/pw4d2/).

3. Results

3.1. Preliminary analyses

Several preliminary analyses set the stage for testing our pre-specified hypotheses. First, using multinomial logistic regression, we found no evidence of treatment-control disparities for gender, age, education, political orientation, or egalitarianism, $LR\ \chi^2(5) = 3.12$, $p = .68$ due to randomization.

Next, a paired-sample t-test confirmed that our treatment respondents—particularly conservative participants—endorsed the *belief in science* items more than the *belief in climate science* items. Without this finding, our hypothesized consistency explanation would be

implausible. This assumption held for treatment participants overall: *belief in science* scores ($M = 6.12$, $SD = 0.74$; 95% CI: 6.04, 6.20) versus *belief in climate science* scores ($M = 5.29$, $SD = 1.48$; 95% CI: 5.14, 5.45), $t(340) = 11.67$, $p < .001$; *Cohen's* $d = 0.70$. A repeated-measures ANOVA showed larger discrepancies for conservative participants' *belief in science* scores relative to their *belief in climate science* scores ($M_{diff} = 1.79$; *Ms* = 6.02 and 4.23, respectively) as compared to their liberal counterparts within the treatment group ($M_{diff} = 0.47$; *Ms* = 6.15 and 5.68, respectively), $F(1) = 49.18$, $p < .001$; *Cohen's* $d = 0.57$.

Finally, a two-sample *t*-test on the full sample revealed no significant differences on the *belief in science* scores between conservatives ($M = 6.02$, $SD = 0.78$; 95% CI: 5.85, 6.18) and their liberal and moderate peers ($M = 6.15$, $SD = 0.73$, 95% CI: 6.06, 6.24), $t(337) = 1.49$, $p = .14$; *Cohen's* $d = 0.18$.

3.2. Hypothesis 1: conservative participants

With these preliminary findings established, we tested our first pre-registered hypothesis that treatment participants would report greater belief in climate science than their control counterparts by fitting an OLS regression model with only our conservative participants. As predicted, conservative participants in the treatment group reported greater belief in climate science ($B = 0.74$, $SE = 0.24$; CI: 0.27, 1.20; $p = .002$; *Cohen's* $d = 0.45$; see Fig. 1A and Appendix C).

We assessed the robustness of this finding by testing whether participants' political orientation moderated the effect of the treatment across the full sample by adding a *Treatment* X *Political orientation* interaction term to the model. This exploratory analysis showed that the intervention significantly bolstered *belief in climate science* for the overall sample ($B = 0.26$, $SE = 0.12$; CI: 0.03, 0.48, $p = .026$; *Cohen's* $d = 0.17$), but that the intervention was primarily effective for more conservative participants ($B = 0.14$, $SE = 0.05$; CI: 0.04, 0.24, $p = .005$; *Cohen's* $d = 0.34$). See Fig. 1A and B and Appendix C.

3.3. Hypothesis 2: treatment x egalitarianism

Second, based on our exploratory study and Kahan's (2013) cultural cognition thesis, we hypothesized that the treatment would increase belief in climate science for participants with less egalitarian worldviews. Although this population overlaps with self-reported conservatives ($r_{(694)} = -0.64$, $p = .001$), the shared variance is about 40%, so the two groups are not identical. This hypothesis was not supported—results showed no evidence that the intervention was more effective for participants who held less egalitarian perspectives ($B = 0.01$, $SE = 0.09$; CI: 0.16, 0.18, $p = .911$; *Cohen's* $d = 0.01$).[1]

4. Discussion

Many Americans harbor doubts about climate change (Leiserowitz et al., 2018). Numerous climate skeptics presumably feel motivated to maintain social consistency with the groups they identify with—holding similar beliefs with others facilitates social harmony (Kahan, 2013; Montoya et al., 2008). This skepticism has impeded the United States' ability to address climate issues. To counter this societal pressure, we tested the efficacy of a cognitive consistency intervention. The intervention successfully shifted the attitudes of politically conservative participants, but did not significantly affect those with less egalitarian, more hierarchical worldviews.

Our results parallel past interventions that shifted climate skeptics' beliefs towards greater acceptance of climate change (e.g., Cook, Lewandowsky, & Ecker, 2017). In addition, our findings support the notion that political orientation predicts climate change beliefs (McCright et al., 2013). Because this finding replicates our exploratory study, finds a large effect size relative to the duration of the intervention, and was pre-registered, we have additional confidence regarding this result.

By contrast, our second hypothesis did not replicate from our exploratory study and diverges from Kahan et al. (2012). Why might this finding fail to replicate? Perhaps the environmental focus of the *belief in climate science* items triggered the salience of participants' (especially control participants') political identities (see Cohen, 2003) to a greater degree than their worldview. Meanwhile, conservatives in the treatment condition might have been partially inoculated against this priming of their political identity through the *belief in science* questions. These items seem unrelated to political orientation or worldview, and thus may have countered whatever social consistency motivation they might have felt. Alternatively, perhaps the relative importance of social consistency with one's political party has increased in the years since Kahan and colleagues conducted these studies making it a more powerful moderator in our analysis than in Kahan's analysis several years ago.

In line with Kahan and his colleagues (Kahan, 2013; Kahan et al., 2012), we posit that motivation for social consistency drives a substantial amount of climate skepticism. This approach then begs the question: With which social groups are climate skeptics trying to make their beliefs consistent? Our data suggest that political party affiliation is defines important groupings.

On a practical note, although we are encouraged that such a brief intervention proved effective, these findings represent more of a proof-of-concept than a field experiment that demonstrates long-term changes in climate skeptics' attitudes. Nevertheless, our data show that believing in science might provide a promising common starting point for productively exploring different perspectives on climate challenges.

The promise of these findings should be balanced against several limitations and the need for additional studies. In addition to moving from a web-based convenience sample to a field experiment, better identifying which groups are most skeptical of climate science and which interventions might work best for them seems pivotal. Second, our intervention only leveraged one consistency motivation. Future field experiments might combine cognitive and social consistency motivations. Such interventions could build from Wolsko's (2017) idea that shared beliefs and building a common in-group identity may change people's environmental attitudes.

Currently in the U.S., few productive climate conversations span the political divide (Geiger & Swim, 2016) despite the urgent need for such discussions. We hope others will further develop consistency strategies like the one used here to catalyze more productive conversations about climate change between parties with opposing perspectives but a common interest in preserving our planet.

Authorship contributions

H.G. developed the intervention, provided funding for the project, and wrote most of the main parts of the manuscript.

C.D.R. contributed to the intervention, administered the study on MTurk, analyzed most of the results, and contributed to writing portions of the manuscript.

C.C.V. conducted most of the background research for the literature review, contributed to the intervention and the measures, and contributed to writing portions of the manuscript.

[1] In line with Simmons, Nelson, and Simonsohn (2011), we also tested our pre-registered hypotheses (using the equations above) without eliminating any participants, i.e., we conducted an "intent-to-treat" analysis. Results remained essentially unchanged for the first ($B = 0.70$, $SE = 0.23$; CI: 0.25, 1.16; $p = .003$; *Cohen's* $d = 0.43$) and second ($B = -0.01$, $SE = 0.08$; CI: 0.17, 0.16; $p = .931$; *Cohen's* $d = 0.01$) hypotheses.

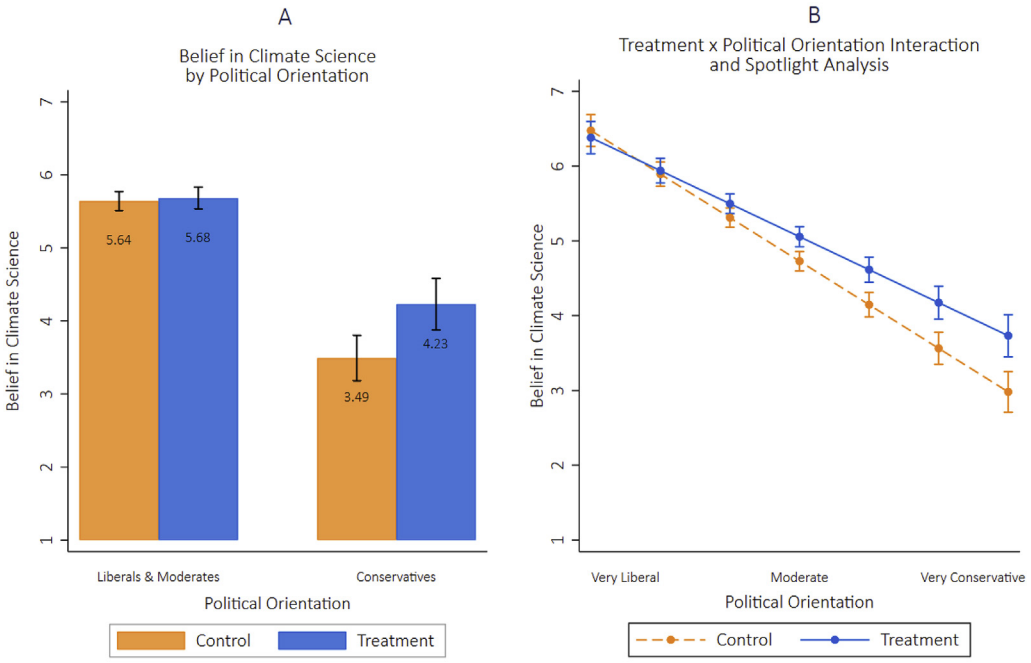

Fig. 1. Differential effects of our intervention for moderates/liberals versus conservatives on the beliefs in climate science (with 95% confidence intervals).

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2018.12.004.

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